**Topical uses for Grindelia species**

by Francis Brinker, ND

Francis Brinker has taught botanical medicine at both National College of Naturopathic Medicine and Southwest College of Naturopathic Medicine and currently teaches in Dr. Andrew Weil’s Program in Integrative Medicine at the University of Arizona. Dr. Brinker has written numerous articles and books on medicinal herbs, including The Eclectic Dispensatory of Botanical Therapeutics, Herb Contraindications and Drug Interactions, and The Toxicology of Botanical Medicine.

Generic characteristics

*Grindelia* spp., New World natives in the Asteracae, formerly Compositae (sunflower) family and commonly called gumweed, received their generic scientific name to honor the Russian botanist David Grindel (1776-1836). Some 45 species are recognized in North America. Most of these annual, biennial, or perennial species are found in northwestern Mexico and the American Southwest in arid or semi-arid climes and saline or alkaline soils (Timmerman, McLaughlin et al 1987). At least 13 species and 44 varieties and forms are found in California, the largest of which is *G. robusta* and the most common being *G. camporum* throughout the southern half of the state (Dunford 1964). *G. camporum* is often identified as *G. robusta* (Cheney 1962). The most widespread species is the smaller *G. squarrosa*, originally from the Great Plains states and west, but now also found east to the Atlantic and south to the Gulf of Mexico. The bract tip distinguishes this genus, having 2-8 deciduous awns that are rigid, smooth, white, and curved (Felter & Lloyd 1983; Ricketts).

These three *Grindelia* species derive their species names from the Latin *robur* (big, strong) and the Greek *campus* (field) and *eschara* (rough, scurfy) (Cheney). White, sticky, resinous material which turns brown upon drying covers the buds, flower heads, and leaves of these species. Since they have the most resinous coating (Kingsolver et al 1984), these are the parts used medicinally. The resins are freely soluble in alcohol (Cheney). The yellowish-brown to yellow powder has a balsamic odor and an aromatic, bitter taste (Felter & Lloyd; National Formulary 1946). The yellow powder has a balsamic odor and an aromatic, bitter taste (Felter & Lloyd; National Formulary 1946).

Aside from their characteristic morphology, the quantities and constituents of the resin, composed of diterpene acids, distinguish the various *Grindelia* species. Those with grindelic acid as the dominant resin component include the major medicinal species. This subgroup is distinct from others by also having significant amounts of 17-substituted homologues of grindelic acid (Timmerman et al). The resin also acts as a feeding deterrent for herbivores (Rose, Jones et al 1981) and protects the plant from solar radiation by preventing water loss (Hoffman et al).

Traditional water extracts and poultices

Native Americans’ use of *G. robusta* was as a tea of the flowering tops applied externally as a wash for poison ivy and poison oak (Cheney). The Miwoks used the leaves as a poultice for running sores. A decoction of *G. camporum* flowers was applied locally by the Costanoan tribe to boils, wounds, and dermatitis from poison oak (Bocek 1984). The Shoshones in the Great Basin Desert used the tea of *G. squarrosa* leaves and the roots or tops as a wash for measles (Shemluck 1982; Murphy 1959). A poultice of the boiled plant was placed over swellings by the Paiutes, while they used a decocted solution as an antiseptic wash (Train, Henrichs et al 1982).

When *G. robusta* is used for poison ivy, a cold infusion can be prepared by extracting ten grams in 500 ml of water for 24 hours (Cheney) or the hot infusion can be made with one teaspoon of dried leaves or flowering tops in one cup of boiling hot water (Lust 1974). The Eclectic Doctor John Fearn recommended the infusion as an application to old ulcers and as a local remedy in chronic eczemas where the sensation of insects crawling on the skin is troublesome (Fearn 1924).
Adoption of *grindelia* fluid extract in medicine

In 1880 *Grindelia robusta* and its 1:1 fluid extract were introduced as official drugs in the *United States Pharmacopoeia* (USP) (Pharmacopoeia of US 1882). The 1890 USP defined the official drug as the leaves and flowering tops of *G. robusta* and *G. squarrosa* (Felter & Lloyd). In 1910 the USP characterized the proper alcohol content for the fluid extract as 75% (Remington 1917). The dried herbs and fluid extract were subsequently listed in the *National Formulary* (NF) in 1926, remaining official there until 1960 (Cheney). The 1946 NF official “*Grindelia robusta*” fluid extract was made using the dried, powdered leaves and flowers of *G. camporum*, *G. squarrosa* or *G. humilis* and contained 57-63% ethanol by volume (National Formulary).

*G. robusta* as a fluid extract was found especially useful for asthma, colds, bronchitis with a harsh cough, and pertussis. Its effects are not apparent from a single dose but with full and frequent doses it produces expectoration and can relieve paroxysmal coughs. It has also been used for irregular heart action accompanied by a chronic cough, as well as kidney and bladder problems. A dose from 10-60 drops of the fluid extract was recommended 3-4 times daily, or 5-20 drops for children (Cheney, Felter & Lloyd). The combination of *G. robusta* with yerba santa (*Eriodictyon californicum*) was believed to be an especially effective combination for persistent respiratory difficulties with catarrhal cough, greenish sputum, and burning or soreness in the chest (Fearn). Yerba santa also helps neutralize the bitter taste of grindelia.

*G. camporum* and *G. squarrosa* are often substituted for *G. robusta* (Cheney; Felter & Lloyd; National Formulary). *G. squarrosa* fluid extract is claimed to have a unique value for intermittent fever in malaria and splenic enlargement. Gastric pain and indigestion or headache and dizziness are associated with the splenic congestion responsive to a tincture of this species (Felter & Lloyd).

Dilute fluid extract applied locally

A lotion with *G. robusta* fluid extract was used effectively to stop the itching of mosquito and flea bites (Anon 1885). It was also said to antidote the bites of both venomous insects and reptiles (Davis 1882; Bloyer 1899). Topically, the dilute fluid extract (one part extract combined with eight parts water) was used for chronic skin disease like eczema and for ulcers, burns, and poison ivy or poison oak (Cheney; Felter & Lloyd; Liast 1974; Anon 1885; Bloyer; Anon 1885). An even greater dilution was sometimes used: 4-6 ml of *G. robusta* fluid extract in eight ounces of pure water.

In California, in the late 19th century, diluted *G. robusta* was considered to be one of the best means to control the itching and burning of poison ivy (Anon 1885; Anon 1888; Anon 1888b). In one case a little girl had an extreme reaction on her hands and face to these rash plants. Her whole face was enormous and had a bright red appearance, and her eyes were swollen completed shut. Cloths saturated in the dilute grindelia extract were applied and changed every hour. The relief from the burning and itching was immediate, and in 24 hours the redness had disappeared (Anon 1883).

Dr H.M. Fiske did not find it as effective for poison ivy as expected, but noted that for burns the fresh bruised herbs when applied frequently over the area relieved the pain and soothed the suffering. For the intense burning and itching of vaginitis, he used one tablespoon (Tbs) of either the tincture or fluid extract mixed with four Tbs water as a vaginal injection 3-4 times daily. In addition, cloths were soaked in this mixture and applied hot to the pubic region (Fiske 1875). A 1:10 dilution of the tincture was also advocated for chronic ulceration of the uterine cervix, applied locally on cotton (Scudder 1877).
**Concurrent use locally and internally**

G. robusta tincture was also said to relieve purulent inflammations of the eye such as conjunctivitis (Davis). A number of cases of iritis were also relieved by its local and internal use. For example, in 1875 a 35-year-old man whose right eye and lids were swollen and protruding had intense pain throughout the entire orbit. The iris was contracted with irregular edges, while the conjunctiva was extremely red with distended vessels. After several days of unsuccessful treatment with leeches and mercury, a compress medicated with 1 The G. robusta fluid extract mixed with 4 Tbs water was applied by Dr. Fiske and kept wet. After several hours there was marked amelioration of the symptoms. Being asthmatic as well, he was also given the fluid extract internally, one teaspoon (4 ml) four times daily. Within 36 hours he had obtained relief from both of his maladies. Another man aged 60 years injured his left eye in the hay field. When home remedies failed him after two days, he visited Dr. Fiske with intense suffering and severe symptoms of iritis. The same internal and external treatment was given and in 20 hours the pain and inflammation were mostly resolved. After several days he returned to work (Fiske).

Chronic indolent ulcers on any part of the body are said to respond well (Anon 1885). In 1875 Dr. John Scudder treated a man of age who had suffered from leg ulcers continuously for 20 years, though treated by physicians and in hospitals. When he first came to Dr. Scudder, his leg was very swollen, mostly above the ankle, and colored purplish black. There were two large ulcers over the tibia, 2 and 3.5 inches in diameter and 0.5 inch deep with abundant and foul secretion. The pain was so severe he could hardly walk. Having just learned of this remedy and obtaining a supply from San Francisco, Scudder prescribed G. robusta. The liquid extract dosage was 10 drops three times daily and locally in a 1:16 dilution, applying about a half ounce twice daily as a wet dressing. Improvement was immediate, so that by the end of a week the leg was free of pain, swelling was greatly reduced, and skin color was better. The ulcers were one third less in size. After several months one of the ulcers had healed and the other was the size of a half dollar and healing, while the patient was able to walk comfortably (Scudder 1875). Scudder later described his recommendation for topical applications as a dilution of 1:0.5 ounce of tincture to a pint of water, when making a wet dressing for local use once or twice daily. Sometimes this was applied together with a small internal dose three times daily (Scudder 1881).**

**Differences in fluid extracts due to freshness, alcoholic content, and species**

Dr. W.H. Davis observed that the old dried plant was nearly inert, so that the fluid extract should be made from the fresh herb, especially the flower heads covered with the medicinal balsamic resin (Davis). The pure ethanolic extract of G. robusta is dark green to yellowish brown with a strong balsamic odor and produces a cloudy precipitate when added to water. The dark reddish extract made with dilute alcohol, almost odorless and tasteless, will form precipitates if added to twice its bulk in strong alcohol (Lloyd 1878). The pharmacists W.S. Merrell & Co. produced the fluid extract of dark green color that turned milky in water. On the other hand, Parke, Davis & Co. manufactured a dark wine-colored extract that simply lightened in color when added to water (Kinnett 1882).

Though Parke, Davis & Co. had introduced the fluid extract (Felter & Lloyd), the green extract made with strong alcohol was thought by John Uri Lloyd to be preferable due to its resin content, though it was not specified for what conditions (Lloyd). However, aside from a few cases of asthma and old ulcers, many failures were experienced by a doctor using the dark green extract in cases similar to those successfully treated by others using grindelia extracts. Others in 1881 challenged Lloyd’s status as an authority in this matter (Kinnett). Based on eventual 1940s NF standards after Lloyd’s passing, the lower alcohol content preference won out (National Formulary).

While topical uses of different *Grindelia* species were similar, the Eclectics maintained separate internal therapeutic identities in certain regards for the major therapeutic *Grindelia* species. Yet, similarities were also apparent. This led to an observation in the Eclectic classic, *King's American Dispensatory*, on this issue: “Why two plants so closely allied as the *G. robusta* and *G. squarrosa*, and possessing nearly identical constituents, should give such discordant therapeutic results, is certainly enigmatical. The fact is, that many physicians have a great proneness to run after new remedies, especially when introduced under some pretentious
Hoffmann collects the aerial parts of G. camporum, G. squarrosa, or a third species, G. cuneifolia. Likewise, the applications of a decocted water extract and various hydroalcoholic extracts was not differentiated. Described as an old naturopathic favorite, the liquid extracts were applied externally to lacerations, poorly healing ulcers, and with frequency to eczema, impetigo, allergic dermatitis, and poison ivy reactions (Kuts-Cheraux 1953). The naturopathic herbalist John Lust only refers to the species G. robusta. In his discussion he describes using the infusion of the leaves and flowering tops externally as a wash for burns, rashes, blisters, and inflammations. Using dried parts only, the tea was made by steeping 1 teaspoon of the leaves or flowering tops in a cup of boiling hot water. A fluid extract, diluted 6-10 times with water, was preferred as a local treatment for poison ivy irritation (Lust).

In his description of grindelia Michael Moore also did not distinguish between species. He collects the leaves before flowering and the flowerheads and buds when first in bloom and dries them in the shade (never in the sun). For making tea the leaves and flowers are deemed interchangeable, but he indicates that the flowers are preferable for tinctures. He recommends the tincture or poultice of the crushed flowers be applied externally to treat poison ivy rash (Moore 1979). David Hoffman collects the aerial parts of G. camporum before the flower buds open and dries them as soon as possible in the sun. Externally, his primary use is in a lotion for poison ivy irritation (Hoffmann 1996).

Component variations between species

The similar uses for the different species, parts, and extracts should be considered in the context of components and their relative solubilities. Since both water and hydroalcoholic extracts has been used topically, it would seem that components like resins that are most soluble in high alcohol extracts might not be as important in preparations for topical application as they might be for some internal conditions such as respiratory infections.

The resins have been the most widely investigated components of these plants. For G. robusta the amounts can vary considerably. Reportedly, ranges from 21-22% or 5.3-6.0% crude resin can be found in the above-ground dried plants, with half of this resin composed of resin acids (Timmerman et al). The hydroalcoholic extract in one study yielded 8% resin from which was obtained the water-insoluble diterpene grindelic acid (Panzuti, Mangoni et al 1962). The saponin fraction largely contained a triterpenoid lactone, grindeliaapogenin D. Oleoresinolic acid and bayogenin were found in its commercial alcoholic extracts but were not associated with its antimicrobial activity (Kreutzer, Schimmer et al 1990). The essential oil makes up about 0.2% of the aerial plant (Kaltenbach, Schimmer et al 1991). The dominant components of the essential oil are α-pinene, equivalent in the oils from the flowers and leaves, and germacrene-D which had over twice the yield in oil from the leaves. The leaf oil also contains a significant amount of myrcene (Schäfer, Schimmer et al 1993).

G. camporum resin ranges from 5-18% of the dry plant weight with 30% of this as grindelic acid (Hoffman, Kingsober et al). In addition, the resin contains diterpene derivatives and their methyl esters plus stictanonic acid. The flavonoids apigenin 4'-methyl ether, quercetin and its 3,3'-dimethyl ether, and kaempferol 3,7-dimethyl ether, together with plant sterols, are also present (Hoffman, Kingsober et al; Timmerman, Hoffmann et al 1985; Bohlmann, Ahmed et al 1982). Major constituents in the essential oil from the flowers and leaves include limonene, α-pinene, and germacrene-D (Schäfer, Schimmer et al). Other volatile components include δ-farnesene, α-humulene, bisabolene, myrcene, β-pinene, and bornyl acetate (Schäfer, Schimmer et al; Bohlmann, Ahmed et al).

G. squarrosa resin has been reported as 13% of the above-ground dried plant, and resin acids account for about 75% of the total resin (Timmerman, McLaughlin et al). These include grindelic acid, at least six of its derivatives, five 17-substituted grindelic acid homologues, and stictanonic acid (Timmerman, Hoffmann et al). The flowers of G. squarrosa contain the flavonoids quercetin, 3-methylquercetin, 3,3′-dimethylquercetin, 3-methylkaempferol, 3,7-dimethylkaempferol, and lutelol (Törck, Pinkas et al).
Chrysoeriol 7-glucuronide was also identified in the aerial parts (Wagner, Iyengar et al 1972). Other components of the flowers include saponins and grindelol, a phytosterol glycoside (Kolikowska 1960). The essential oil of the herb is about 0.2% (Kaltenbach, Schimmer et al). While the flowers contain large amounts of α-pinene and significant limonene, limonene was somewhat more dominant in the oil from the leaves than pinene (Schaefer, Schimmer et al).

Extract and flavonoid pharmacological activities

The antimicrobial effects of *G. robusta* is due at least in part to the resin fraction but not its saponins (Kreutzer, Schimmer et al). In testing alcoholic extracts from leaves of *G. squarrosa*, the antibacterial activity was similar to the official *G. robusta* extract of the French pharmacopeia. The *G. squarrosa* extract contained grindelic acid, luteolol, and several phenolic acids (Didey, Pinkas et al 1982). *G. squarrosa* methanolic extract strongly inhibited the fungus *Trichophyton mentagrophytes* (McChesney & Adams 1985). Both the fluid extract and methanolic extract showed significant antibacterial effects against pathogenic gram-positive and gram-negative organisms *in vitro* (Train, Henrichs et al; McChesney & Adams).

A flavonoid mixture with apigenin, luteolin, kaempferol, and quercetin showed potent anti-inflammatory action (Adzet 1986; Middleton 1988). Quercetin, luteolin, kaempferol, and apigenin inhibit transcriptional activation of COX-2 *in vitro* (Liang, Huang et al 1999; Mutoh, Takahashi et al 2000). Quercetin inhibits neutrophil degranulation and superoxide production. Its inhibition of phospholipase A2 and 5-lipoxygenase reduces the production of inflammatory and allergic leukotrienes and HETE. Quercetin also inhibits antigen-induced histamine release from basophils of people with hay fever (Adzet, Middleton). Luteolin and apigenin likewise inhibit histamine release. Luteolin, quercetin, and kaempferol prevent lipid peroxidation that can cause cell damage. The flavonoids 3-methylquercetin and 3,3′-dimethylquercetin exhibit antiviral activity *in vitro* and *in vivo* (Middleton). While all of these activities cannot be assumed to necessarily be found with *Grindelia* species and their limited content of flavonoids and derivatives, some of these influences may be expected to contribute to the observed anti-inflammatory effects of these herbs.

Conclusions

The consistent use of *Grindelia* species for similar conditions by different American ethnic cultures is notable. Empirical effects found with water extracts for poison ivy may be associated with flavonoid anti-inflammatory and anti-allergic activities. Applications as a poultice for non-healing wounds and ulcers suggest the local antimicrobial effects of the external resins are substantial. The limited solubility of resins in water may reduce the antiseptic effects of these extracts. Some resin extraction with water is expected, however, due to other phytochemical solutes in the extract changing the solvency of the medium in comparison to pure water.

Later practitioners seem to prefer the application of alcoholic extracts for poison ivy dermatitis and for infections. The contribution of the resins to the reduction of inflammation is unknown. It seems likely that the volatile oils, grindelic acids, and their derivatives in the resin extracted with alcohol help control infectious conditions. Though the resin of *Grindelia* species has been assumed to carry its therapeutic activity, pure alcohol extracts did not supplant hydroalcoholic or aqueous extracts.

The working assumption has been that interchanging similar preparations of *G. robusta*, *G. squarrosa* and other species is usually appropriate. This appears to be true as regards their topical applications for inflammation and infections. Systemic influence with internal administration has potentially broader effects that may require greater selectivity. Historical usage deserves further examination by modern methods to develop better understanding as to which preparations and species may be preferable for particular conditions, locally and internally.

References

Adzet T 1986. Polyphenolic compounds with biological and pharmacological activity. *Herbs, Spices and Medicinal Plants*, 1: 167-84